REMARKS

In the last Office Action, the Examiner rejected claims 1, 3, 4, 19, 20 and 22-30 under 35 U.S.C. §103(a) as being unpatentable over applicant's prior art disclosure in Fig. 7 ("APD") in view of U.S. Patent No. 5,917,569 to Tanuma et al. ("Tanuma") and further in view of U.S. Patent No. 5,390,037 to Negishi.

In accordance with the present response, independent claims 1, 23 and 26 have been amended to define with more particularity the falling direction of the liquid crystal molecules prescribed in the fifth step (claim 1) and the continuously feeding steps (claims 23, 26) of the claimed manufacturing method. As discussed in detailed below, this feature is not disclosed or suggested by the combined teachings of APD, Tanuma and Negishi.

Non-elected claims 11, 13-16 and 18 are been retained in the application pending possible withdrawal of the restriction requirement or allowance of a generic or sub-generic claim. Applicant submits that claims 1, 3, 4, 19-20 and 22-30 are generic to Species A and B identified by the Examiner in the December 10, 2004 Office Action, and it is applicant's understanding that the restriction requirement will be withdrawn upon the allowance of any one of these (or any other) generic claims.

The amendments to the claims made herein do not raise new issues requiring further search and/or consideration. Instead, independent claims 1, 23 and 26 have been amended to define with more particularity the falling direction of the liquid crystal molecules prescribed in the claimed method steps which patentably distinguish the claims over the prior art of record, thereby placing the application in condition for allowance or otherwise reducing the issues which remain for appeal.

Applicant requests consideration of his application in light of the following discussion.

Brief Summary of the Invention

The present invention is directed to a method for manufacturing a liquid display unit.

As described in the specification (pages 1-5), conventional methods for manufacturing liquid crystal display units have been complicated to carry out due to their complexity and low productivity. Additionally, the conventional manufacturing methods have often resulted in damage to a polymeric substrate of the manufactured liquid crystal display unit.

The present invention overcomes the drawbacks of the conventional art. Figs. 1-2 show an embodiment of a method for manufacturing a liquid crystal display unit according to the present invention embodied in the claims. In the manufacturing method, a roll of a flexible polymeric substrate 1 having a longitudinal length longer than a transversal width is provided. Transparent electrodes 2 and a vertical orientation film 3 are then formed on the flexible polymeric substrate 1. The vertical orientation film 3 is then solidified. A falling direction of molecules of a liquid crystal having a negative dielectric anisotropy in the vertical orientation film 3 is then prescribed, the falling direction being prescribed in parallel with a phase advancing axis or a phase delaying axis of an optical anisotropy of the flexible polymeric substrate 1. Thereafter, the flexible polymeric substrate 1 is connected to an opposed flexible polymeric substrate 4 to define a gap therebetween. A liquid crystal 8 is then disposed in the gap between the flexible polymeric substrates 1, 4.

The flexible polymeric substrate 1 is continuously fed from the roll in the longitudinal direction during the formation of the formation of the transparent electrodes 2 and the vertical orientation film 3, during solidification of the vertical orientation film 3, during prescription of the

falling direction of liquid crystal molecules in the vertical orientation film 3, and during connection of the flexible polymeric substrates 1, 4.

By the foregoing manufacturing method according to the present invention, the liquid crystal display unit can be manufactured with a simple process by continuously feeding the flexible polymeric substrate from a roll, thereby increasing productivity and avoiding damage to the flexible polymeric substrate. Furthermore, it is sufficient to prescribe the falling direction of the liquid crystal molecules in parallel with a phase advancing axis or a phase delaying axis of an optical anisotropy of the flexible polymeric substrate at any time irrespective of the characteristic specification of a liquid crystal display. By this method, it is possible to assemble upper and lower substrates of the liquid crystal display unit such that the orientation directions of the substrates are opposed to each other while the elongated substrates are used as they are. Therefore, the liquid crystal unit of the polymeric substrate can be manufactured with high productivity.

Traversal of Prior Art Rejection

Claims 1, 3, 4, 19, 20 and 22-30 were rejected under 35 U.S.C. §103(a) as being unpatentable over APD in view of Tanuma and further in view of Negishi. Applicant respectfully traverses this rejection and submits that the combined teachings of APD, Tanuma and Negishi do not disclose or suggest the subject matter recited in amended independent claims 1, 23 and 26 and corresponding dependent claims 3, 4, 19, 20, 22, 24, 25 and 27-30.

Amended independent claim 1 is directed a manufacturing method of a liquid crystal display unit and requires a step (i.e., third step) of forming a vertical orientation film on the first flexible polymeric substrate, and a step (i.e., fifth step) of prescribing a falling direction of molecules of a liquid crystal having a negative dielectric anisotropy in the vertical orientation film, the falling direction being prescribed in parallel with a phase advancing axis or a phase delaying axis of an optical anisotropy of the first flexible polymeric substrate. Claim 1 further requires that the first flexible polymeric substrate is continuously fed from the roll in the longitudinal direction during the steps recited in claim 1. No corresponding combination of steps is disclosed or suggested by the combined teachings of APD, Tanuma and Nigishi.

APD discloses a method of manufacturing a liquid crystal display unit including steps of forming a polymeric substrate and transparent electrodes, the formation and solidification of an orientation film, and an orientation step for liquid crystal molecules in the orientation film. However, as recognized by the Examiner, APD does not disclose or suggest the formation of an orientation film which is vertically aligned, as recited in claim 1. Likewise, APD clearly does not disclose or suggest that the polymeric substrate is a flexible polymeric substrate that is continuously fed from a roll in the longitudinal direction during the steps recited in amended claim 1.

Moreover, as further recognized by the Examiner, APD does not disclose or suggest a step of prescribing a falling direction of molecules of a liquid crystal having a negative dielectric anisotropy in the vertical orientation film, the falling direction being prescribed in parallel with a phase advancing axis or a phase delaying axis of an optical anisotropy of the first flexible polymeric substrate, as recited in amended claim 1.

The secondary reference to Tanuma discloses a process for forming a vertical orientation film by moving a substrate. More specifically, as shown in Figs. 12(a)-(c) of Tanuma, an alignment film is rubbed using a rubbing roll 21

while the substrate 11 is moved relative to the rubbing roll via a stage 22. However, Tanuma does not disclose or suggest that the substrate 11 is a flexible polymeric substrate that is continuously fed from a roll in the longitudinal direction during the second, third, fourth, fifth and sixth steps recited in amended claim 1.

Furthermore, Tanuma does not disclose or suggest a step of prescribing a falling direction of molecules of a liquid crystal having a negative dielectric anisotropy in the vertical orientation film, the falling direction being prescribed in parallel with a phase advancing axis or a phase delaying axis of an optical anisotropy of the first flexible polymeric substrate, as recited in amended claim 1. In this regard, while disclosing a process for forming a vertical orientation film by moving a substrate, Tanuma discloses only a twisted-nematic mode, not a vertical orientation mode. Fig. 11b of Tanuma discloses an induction electric field between pixel electrode 13 and line 14 resulting in an abnormal orientation region. Thus, the falling direction of liquid crystal molecules disclosed by Tanuma does not have the specific parallel orientation relative to a phase advancing axis or a phase delaying axis of the optical anisotropy of a flexible polymeric substrate, as required by amended claim 1.

The secondary reference to Negishi discloses a process for forming an orientation film by continuously conveying a film substrate between a rubbing roll 13a and a backup roll. During the rubbing process, the rubbing roll 13a has a rubbing angle relative to a longitudinal direction of the film substrate. This rubbing angle varies according to a characteristic of a liquid crystal. However, Negishi does not address the specific vertical orientation film and prescribed falling direction of the liquid crystal molecules recited in amended claim 1.

Since Tanuma and Negishi do not disclose or suggest the foregoing steps recited in amended claim 1, they does not cure the deficiencies of APD. Accordingly, one ordinarily skilled in the art would not have been led to modify the references to attain the claimed subject matter.

Amended independent claim 23 requires the step of prescribing a falling direction of liquid crystal molecules in the vertical orientation film so that the falling direction is prescribed in parallel with a phase advancing axis or a phase delaying axis of an optical anisotropy of the flexible polymeric substrate. Likewise, amended claim 26 requires the steps of prescribing a falling direction of liquid crystal molecules in the vertical orientation film so that the falling

direction is prescribed in parallel to a phase advancing axis or a phase delaying axis of an optical anisotropy of the first flexible polymeric substrate, and prescribing a falling direction of liquid crystal molecules in the vertical orientation film formed on the second polymeric substrate so that the falling direction is prescribed in parallel to a phase advancing axis or a phase delaying axis of an optical anisotropy of the second flexible polymeric substrate. No corresponding steps are disclosed or suggested by the prior art of record as set forth above for amended independent claim 1.

Claims 3, 4, 19, 20, 22, and 24, 25 and 27-30 depend on and contain all of the limitations of amended independent claims 1, 23 and 26, respectively, and, therefore, distinguish from the cited references at least in the same manner as claims 1, 23 and 26.

In view of the foregoing, applicant respectfully requests that the rejection of claims 1, 3, 4, 19, 20 and 22-30 under 35 U.S.C. §103(a) as being unpatentable over APD in view of Tanuma and further in view of Negishi be withdrawn.

The amendments to the claims made herein do not raise new issues requiring further search and/or consideration. Instead, independent claims 1, 23 and 26 have been amended to define with more particularity the falling

direction of the liquid crystal molecules prescribed in the claimed method steps which patentably distinguish the claims over the prior art of record, thereby placing the application in condition for allowance or otherwise reducing the issues which remain for appeal.

In view of the foregoing amendments and discussion, the application is believed to be in allowable form. Accordingly, entry of this amendment and favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

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